DRAFT

AMERICAN RIVER WATERSHED PROJECT
COMMON FEATURES

LOWER AMERICAN RIVER FEATURES

MAYHEW LEVEE

SACRAMENTO COUNTY, CALIFORNIA

PLAN SELECTION REPORT

October 10, 2006

U.S. Army Corps of Engineers
Sacramento District
South Pacific Division

CONTENTS

TABLES

PLATES

APPENDIXES

1.0 INTRODUCTION

1.1 PURPOSE

This report discusses the development, evaluation, and comparison of alternative plans for refining the Mayhew Levee separable element of the American River Common Features Project. This discussion provides documentation to support the decision-making process leading to the revised Federally recommended plan for the project.

1.2 PROJECT AREA

The Mayhew Levee project area is located along the south bank of the lower American River at approximately river mile 11.5 in Sacramento County as shown on Plate 1. The project area extends from the Mayhew Drain culvert upstream for approximately 4,300 linear feet where the levee ties into high ground near the Gristmill Park access to the American River Parkway (Parkway). The levee is located in the Parkway on land owned and managed by Sacramento County. Constructed in the mid-1970's by local interests, this levee does not meet current Corps engineering standards and is not maintained as part of the Federally authorized levee system along the lower American River.

The existing Mayhew levee averages 5 feet high and has approximately 2H:1V landside and 3H:1V waterside slopes. The levee crown varies between 11 and 13 feet in width and is covered with aggregate base material. The landside of the levee is adjacent to the back yards of private homes, which are fenced near the landside toe of the levee. The waterside of the levee is inside the Parkway. Vegetation along the levee includes grasses with riparian trees and elderberry shrubs at the waterside levee toe. Maintenance vehicles from Sacramento County access the levee via the Gristmill Park road and travel along the levee crown. Regular maintenance activities include clearing vegetation on the levee, removing trash, and repairing the access gate, as needed. Private vehicle access to the levee crown is not permitted.

Typical fence line of residences adjacent to Mayhew Levee

Trees adjacent to the levee

1.3 BACKGROUND

In April 1991, the U.S. Army Corps of Engineers (Corps) and the State of California Reclamation Board (Reclamation Board) issued the American River Watershed Investigation, Feasibility Report and Environmental Impact Statement/Environmental Impact Report (EIS/EIR). These reports included the results of studies on flooding problems along the American and Sacramento Rivers in the greater Sacramento area.

As a result of the 1991 feasibility report, Congress directed the Corps and its local sponsors to prepare the American River Watershed Investigation Supplemental Information Report (SIR), dated March 1996, to provide additional information and details on the alternatives presented in the report. The SIR evaluated a variety of alternatives to provide increased flood control to the Sacramento area.

In June 1996, the Chief of Engineers issued his report, which deferred a decision on the recommended detention dam alternative as a comprehensive flood control plan. However, as a first step toward a comprehensive flood prevention plan for Sacramento, the Chief did recommend that the features common to the three candidate plans evaluated in the SIR be authorized. Although the Federal Administration did not make a recommendation to Congress, these “common features” were included in the Water Resources Development Act (WRDA) of 1996 (Public Law 104-303). The Common Features Project authorized in 1996 consisted of the following:

- Stabilizing about 24 miles, via slurry wall construction, of existing levees along the lower American River and about one-half mile along the Garden Highway. The Mayhew levee was included in this work.
- Raising and stabilizing about 12 miles of levees at various locations along the east bank of the Sacramento River in the Natomas area.
- Implementing a telemeter inflow gage system upstream from Folsom Reservoir.
- Modifying the flood warning system along the lower American River.

The California State Legislature authorized the Common Features Project via Water Code 12670.10 in 1997. The Corps signed the Record of Decision on the Common Features Project on July 1, 1997. Additional National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) documents were prepared, as required, as each of these project features was refined. These documents were specific to the feature or features being refined. Also, in August 1997, the Corps prepared the 1st Addendum to the SIR to further describe the common features and present an independent MCACES cost estimate for these features.

As a result of further engineering studies, Section 366 of WRDA 1999 (Public Law 106-53) authorized numerous specific additions to the Common Features Project along the lower American River and in the Natomas Basin. Those additional modifications along the lower American River included:

- Raising the left bank of the non-Federal levee upstream of the Mayhew Drain for a distance of 4,500 feet by an average of 2.5 feet,

- Installing gates to the existing Mayhew Drain culvert to prevent backup of floodwater on the Folsom Boulevard side of the gates,
- Raising the right bank of the American River levee from 1,500 feet upstream to 4,000 feet downstream of the Howe Avenue Bridge by an average of 1 foot,
- Installing a slurry wall in the north levee of the American River from the east levee of the Natomas East Main Drainage Canal upstream for a distance of about 1.2 miles, and
- Installing a slurry wall in the north levee of the American River from 300 feet west of Jacob Lane east for a distance of about 1 mile to the end of the existing levee.

The flood of 1997 provided additional design data for changing the design of cutoff walls and need for jet grouting around bridges and deep utilities that was not anticipated during original design. Geotechnical analysis indicated that only 20.7 miles, rather than 24 miles, of cutoff wall were required and the required design depth of the slurry wall increased from an average of 25 feet to an average of 65 feet for under seepage control. Further analysis also changed the location of Mayhew Drain gates from Folsom Boulevard to near the mouth of Mayhew Drain and concluded that pumps may not be needed. To prevent seepage along the Mayhew Drain levees upstream of the relocated closure structure, the concrete lining of the levees along the Drain would be extended vertically.

A 2nd Addendum to the SIR was prepared in 2002 to describe the project as authorized in WRDA 1999 and to support an amendment to the PCA. Additional National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) documents were prepared again, as required. An Environmental Assessment/Initial Study (EA/IS) was prepared by the Corps and the Reclamation Board for the proposed modifications to the Common Features Project, including the raising of the left bank of the non-Federal levee upstream of the Mayhew Drain and the installation of gates at the Mayhew Drain culvert. During circulation of the EA/IS in 2001, the public objected to the environmental impact of the proposed levee raising upstream of Mayhew Drain as authorized under WRDA 1999. The proposed levee raise would have extended the project footprint approximately 20 feet into a reach of the lower American River Parkway that was valued for greenbelt habitat and a number of mature oak trees. In response to community objections, the Corps of Engineers and project stakeholders developed an alternative design that included use of a floodwall at selected locations to preserve several mature oak trees. As a result, the 2nd Addendum recommended a levee and floodwall design that would preserve the oak trees. A Final Finding of No Significant Impact (FONSI) was signed on April 5, 2002 by the Corps' District Engineer. The 2nd Addendum was approved by the Chief of Engineers in his report to ASA(CW) dated 21 October 2002.

After the approval of the project, many alternative designs for the Mayhew levee were investigated while meeting with local interests. However, during the design studies, it was found that construction impacts would jeopardize the health of the trees with possible damage to the floodwall. Also, the floodwall could not be constructed in strict adherence to Corps design criteria. Therefore, after meeting with local interests and stake holders, it was recommended that the floodwall not be included in the design.

In November 2005, draft EIS/EIR specific to the Mayhew Levee was circulated for public review in. The draft document presented and evaluated the potential environmental effects of five alternative designs to raise and improve the Mayhew levee with the recommendation for a levee with no floodwall. Evaluation of the closure at the Mayhew Drain was accomplished in the 2001 EA/IS for the 2nd Addendum to the SIR.

1.4 NEED FOR PROJECT

The Mayhew Levee project would reduce the potential for flood damages and loss of life in the adjacent residential area by ensuring that the levee could safely contain flows in the American River resulting from an emergency release from Folsom Dam of 160,000 cfs in the American River.

The need for the project was emphasized during major storms that caused record floodflows in 1986, 1995, and 1997 in the American River Basin. In 1986, outflows from Folsom Reservoir, together with high flows in the Sacramento River, caused water levels in the American River to rise above the safety margin for the levees protecting the Sacramento area. These major storms raised concerns over the adequacy of the existing flood control system, which led to a series of investigations of the need to provide additional protection for Sacramento. Results of the investigations indicated that the levee in the project area is currently the lowest levee along the American River levee system. As a result, high floodflows in the American River would tend to overtop this levee first, inundating the nearby residential area.

1.5 SIGNIFICANT ISSUES

The significant issues related to construction of the Mayhew Levee project are summarized below. These issues are based on input from formal and informal agency meetings, workshops, public meetings, telephone interviews, letters/emails, and comments on the November 2005 draft EIS/EIR.

- Provision of flood protection to nearby homes and roads.
- Loss of acreage in the Parkway.
- Loss of mature oaks trees and other trees in the Parkway.
- Potential effects to wildlife habitat.
- Degradation of recreation and esthetics.
- Visual effect of and graffiti on floodwalls.
- Increased use of the Gristmill Park area.
- Increased traffic and noise during construction.
- Post-project flood plain and drainage conditions.
- Air quality effects due to dust.
- Width of maintenance road.
- Consistency with American River Parkway Plan.
- Consistency with the Corps' environmental operating principles.

Based on these issues, the environmental goals of the project are to:

- Avoid adverse effects on mature oak trees along the existing levee.
- Minimize the effects of the project on adjacent land use and vegetation.

- Maintain recreation access to the Parkway and preserve its designated wild and scenic values.
- Maintain the visual qualities of the levee to users of the adjacent Parkway and neighboring residents.

2.0 PLANNING PROCESS

The Corps' planning process for flood damage reduction projects involves six steps: (1) identifying problems and opportunities, (2) inventorying and forecasting conditions, (3) formulating alternative plans, (4) evaluating alternative plans, (5) comparing alternative plans, and (6) selecting a plan (WRC, 1983). Within this framework, the Corps seeks to balance both environmental needs and economic factors as it addresses flood problems.

Corps planning is an iterative process that involves identification, evaluation, and comparison of measures and alternatives to develop a reasonable range of final alternative plans for consideration by decision-makers and the general public. For the Mayhew Levee project, the planning process included each of the following basic tasks:

- Establish specific objectives to resolve the identified flood problems.
- Define criteria and constraints for formulating and identifying implementable plans.
- Develop measures to resolve the identified flood problems. Evaluate how well these measures satisfy the specific planning objectives while considering the constraints. Eliminate those measures that do not satisfy the objectives.
- Develop a variety of alternatives from single or combined measures.
- Evaluate, compare, and reformulate/refine the alternatives, resulting in an array of final alternatives for further consideration.

2.1 OBJECTIVES AND CONSTRAINTS

An objective is a statement of the intended purposes of the planning process. The following planning objectives were developed and used in the development of alternatives:

- Reduce flood damages in the Mayhew area from overflows of the American River. Non-Federal sponsor's objective is a high degree of protection appropriate to the extensive potential damage and loss of life that would ensue from an American River flood.
- Preserve the ecosystem structure, function, and dynamic processes in the American River watershed.

A constraint is a restriction that limits the extent of the planning process. Following are the major constraints for the Mayhew Levee project:

- Scope of the alternatives is defined by WRDA 1999, which authorized raising the left bank of the non-Federal levee upstream of the Mayhew Drain for a distance of 4,500 feet by an average of 2.5 feet.
- Levee raising work on left bank must be solely for flood damage reduction.
- Disturbance of habitat of threatened and endangered species must be minimized.

- Numerous laws, regulations, executive orders, and policies must be considered, including NEPA, the Fish and Wildlife Coordination Act, the Clean Air Act, and the Clean Water Act.

2.2 DESIGN CRITERIA AND REGULATIONS

2.2.1 Corps of Engineers

The Mayhew Levee project involves modifying an existing levee so that it conforms to mandatory engineering criteria for design and construction of levees for acceptance of the levee into the Federal Project Levee System. The Corps currently has engineering standards for levees that are constructed as part of a Federally authorized flood control project. These standards are found in the following:

- Engineer Manual (EM) 1110-2-301, "Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, and Embankment Dams," January 1, 2000. As stated in this EM: "Safety of the structure, including its effective maintenance, will be the most important consideration in determining the type, size, growth habit, quantity, and arrangement of plants."

- EM 1110-2-1913, "Design and Construction of Levees," April 30, 2000. As stated in this EM: "Vegetation can be incorporated in the project as long as it will not diminish the integrity and functionality of the embankment system or impede ongoing operation, maintenance and floodfighting capability."

The Corps' recommended criteria based on these two EM's are listed and discussed further in Appendix A.

2.2.2 Federal Emergency Management Agency

The project also involves modifying the existing levee such that it meets the FEMA design criteria for levee construction and certification. These criteria are found in the following:

- FEMA 534, "Technical Manual for Dam Owners: Impacts of Plants on Earthen Dams," September 2005. The purpose of this manual is to "provide the dam owner, . . . engineer, and consultant with the fundamental understanding and technical knowledge associated with the potential detrimental impacts of tree and woody vegetation growth on the safety of earthen dams."

- 44 CFR 65.10, "Mapping of areas protected by levee systems." This section describes the types of information that FEMA needs to recognize, on NFIP maps, that a levee system provides protection from the base flood.

For levees to be recognized by FEMA, evidence that adequate design and operation and maintenance systems are in place to provide reasonable assurance that protection from the base flood exists. These requirements include addressing at a minimum criteria associated with freeboard, closures, embankment protection, embankment and foundation stability, settlement, and interior drainage.

2.3 AGENCY AND PUBLIC CONCERNS

The Corps has been coordinating during the past 5 years with various agencies to discuss the concerns and issues of these agencies regarding the project. The other agencies involved in the coordination include:

- National Marine Fisheries Service
- U.S. Fish and Wildlife Service
- California Reclamation Board
- California Department of Water Resources
- State Water Resources Control Board
- Regional Water Quality Control Board
- Sacramento Area Flood Control Agency
- American River Flood Control District
- Sacramento County Department of Regional Parks
- Sacramento Metropolitan Air Quality Management District

Major concerns expressed during both formal meetings and informal discussions involve loss of large mature oak trees shown on Plate 2, loss of parkway land, esthetics of the floodwall, obtaining flood protection for the community, and construction-related effects on the local residents.

To date, the Corps, together with the Reclamation Board, and SAFCA have held two workshops and five public meetings to present the project and obtain public input. Comments received during these workshops/meetings focused on loss of parkway space, loss of mature oak and other trees, desire for flood protection, visual effects of the floodwall, and project design options. In addition, the three government agencies have been working with the Butterfield Riviera East Community Association (BRECA) Focus Group to refine alternatives to reduce the effects on the parkway and parkway landscape.

2.4 MEASURES

The following engineering measures were developed that alone or in various combinations would address the public safety and environmental objectives of the Mayhew Levee project. These measures were developed in coordination with other Federal, State, and local agencies, neighborhood groups, and individuals as discussed in Section 2.4.

2.4.1 Standard Corps Levee

This measure incorporates the current Corps engineering standards discussed in Section 2.2.1., specifically EM 1110-2-1913. The standard Corps levee for the Sacramento River/American River Flood Control Project is a compacted earthen berm with a 3H:1V waterside slope, a 20-foot crown width, and a 2H:1V landside slope. The design requires a minimum of 10 feet of vegetation-free space on each side to permit vehicle access for routine maintenance and flood fighting activities. Assuming a height of 8 feet to provide the design freeboard required for the project, the standard Corps levee would have a base width of about 60 feet.

2.4.2 Non-standard Levee

This measure incorporates Corps engineering standards for levee construction except that it includes a steeper waterside slope than the standard Corps levee. The non-standard levee is a compacted earthen berm with a 2H:1V waterside slope, a 20-foot crown width, and a 2H:1V landside slope. The design includes a minimum of 10 feet of vegetation-free space on each side to permit vehicle access for routine maintenance and flood fighting activities. Because the steeper waterside slope creates a greater risk of erosion and surface sloughing when flows in the river are at the 160,000-cfs design, the non-standard levee includes the following features to offset this risk: (1) more select soil materials and higher compaction rates, (2) several layers of geogrid material extending 10 to 12 feet back from the waterside slope to increase the stability of the structure, and (3) articulated concrete block mats or engineered rock along the waterside slope to prevent erosion. Assuming a height of 8 feet to provide the design freeboard required for the project, the non-standard levee would have a base width of approximately 54.5 feet if articulated concrete block mats are used and 56.5 feet if engineered rock is used.

2.4.3 Floodwall

This measure involves construction of a concrete wall, approximately 2 feet thick, anchored into a subsurface concrete foundation designed to create an inverted "T." The design includes a minimum of 10 feet of vegetation-free space on each side of the wall to permit vehicle access for routine maintenance and flood fighting activities. In order to address the visual effect of placing the wall in a natural setting, the design would include screening through the placement of soil material on each side of the wall. This material could be incorporated into the design maintenance space to reduce the base width of the structure. Assuming a height of 8 feet, this structure would have a base width of approximately 42 feet with screening covering the lower 5 feet on both sides of the wall.

2.4.4 Slurry Wall

This measure involves construction of a sub-surface barrier to prevent water from migrating through the soil materials below a levee or floodwall with sufficient force to rupture the ground surface on the landside of the structure, thus creating a pathway for transporting enough foundation soil material to trigger a failure of the structure. Depending on the permeability of the affected soils, such force could be generated by flood-induced high water in the river channel. The low permeability barrier would be constructed of a mixture of soil cement and bentonite produced at the project site and formed into a wall through its placement into an excavated subsurface trench. Because of the permeability of the soil materials at the project site, a slurry wall would be installed with all of the other measures.

2.4.5 Geogrids/Overlying Cover

Several methods were considered to stabilize a steeper 2H:1V waterside slope. These included (1) geogrids without an overlying layer of erosion-resistant material, (2) geogrids with an overlaying layer of articulated concrete block mat, and (3) geogrids with an overlying layer of engineered rock. The third method was determined to be the most feasible.

Geogrids without Overlying Layer

At the request of several residents in the community, the Corps considered the feasibility of placing synthetic geogrids in the levee embankment in order to steepen the slope from 3H:1V to 2H:1V to decrease the levee footprint area. The goal was to reduce the amount of Parkway area converted to flood control levee. They specifically referred to previous geogrid applications in levee improvement projects in the Sacramento and New Orleans Districts.

The Corps researched these previous applications and determined that both districts have installed geogrids in the lower part of levees to reinforce soft foundation soils so that levees could be constructed with 3H:1V slopes. Otherwise, even flatter slopes of 4H:1V or 5H:1V would have been required to deflect the energy of flow away from the levee toe. These previous uses in the Sacramento and New Orleans Districts were not intended to reinforce the levees so that slopes steeper than 3H:1V could be constructed.

Based on previous studies and past experience, the Corps does not recommend using geogrids alone in the Mayhew levee to steepen the waterside slope from 3H:1V to 2H:1V for the reasons listed below. The use of geogrids is also discussed in Appendix B.

- Geogrids may improve overall stability of the slope, but they do not effectively stabilize shallow surface slides caused by weathering of the soil, and wet and dry cycles.
- If a slide does occur, it would be more difficult to repair the slope if geogrids are in the embankment.
- Vegetation control on a geogrid-reinforced slope is difficult. Geogrid layers protrude out of the slope and get caught in mowing equipment.
- Constructing a 2H:1V slope with geogrids is more expensive than a 3H:1V slope without geogrids.
- There is sufficient distance between the levee and American River to construct the 3H:1V waterside slope without encroaching into the river channel.

Geogrids with Overlying Concrete Block Mat

This method includes the placement of geogrid material extending 10 to 12 feet back from the waterside slope of the levee and a layer of articulated concrete block matting placed on the slope. This layer is composed of interconnected concrete block units used for erosion protection. The units are connected by geometric interlock and/or cables, geotextiles, or geogrids, and typically include a geotextile underlayer for subsoil retention. The articulated concrete blocks would be covered with 6 inches of soil and seeded with native grasses. Past studies and experience with concrete block mats have shown that these structures may not remain in place during high flows. The block mats are not a contiguous, seamless surface, and the pressure from the water flow pushes between the seams and under the blocks. In addition, the block mats cost more to install than engineered rock; maintenance is more costly because the blocks are interconnected; and the resulting reduction in base width as compared to engineered rock would be minimal. For these reasons, this method was not considered further.

Geogrids with Overlying Layer of Engineered Rock

This method would be the same as using concrete block mat except that a layer of engineered rock would be placed over the geogrid on the slope. The rock would then be covered with 6 inches of soil and seeded with grasses. Engineering rock is less costly to install than concrete block mat; maintenance is less costly because the rocks are not interconnected; and the resulting reduction in base width as compared to concrete block mat would be greater. For these reason, this method was considered further with the 2H:1V slope designs.

3.0 ALTERNATIVES

These five measures were combined into various alternatives that would effectively address the flood protection and environmental objectives of the project. Several alternatives were considered, but not studied in detail, based on agency and local concerns, potential adverse environmental effects, and additional costs. These alternatives are briefly described below, including the specific reasons they were not considered further.

3.1 ALTERNATIVES CONSIDERED BUT NOT STUDIED IN DETAIL

3.1.1 Longer Standard Corps Levee with No Floodwall

This alternative would involve reconstructing approximately 4,500 feet of the existing levee from the Mayhew Drain upstream to where the levee ties into high ground. The levee does not need to be extended above that point because the ground is higher than the 160,000-cfs design water-surface elevation.

The work would include excavating portions of the old levee and then realigning, recontouring, and raising the levee by adding and compacting fill material. During construction, a 50- to 60-foot-deep by 2-foot-wide slurry wall would be installed beneath the new levee to prevent piping of foundation materials and control seepage into the residential area during high flows. The new levee would be 8 feet high and have a 2H:1V landside slope and 3H:1V waterside slope. The levee crown would be 20 feet wide and covered in aggregate base material.

To ensure access for levee inspection and maintenance, the design would include a 10-foot-wide, vegetation-free road along the waterside base of the levee. A 20-foot-wide area would also be included on the landside to allow levee inspection during high flows. Once construction is completed, the new levee slopes would be revegetated using a grass seed mixture to minimize soil erosion.

Public outreach in the community revealed concerns about the adverse effects of the new levee on existing land use, vegetation, mature oaks, and local views. As a result, the Corps reevaluated the design and determined that the length of new levee could be reduced by 200 feet at the upstream end without jeopardizing the public safety goal of the project, and this alternative was not considered further.

3.1.2 Screened and Non-screened Floodwall with No Levee

This alternative would involve replacing approximately 4,300 feet of the existing levee with a partially screened floodwall from the Mayhew Drain upstream to a point where the levee ties into high ground. The levee does not need to be extended above that point because the ground is higher than the 160,000-cfs design water-surface elevation.

The work would include excavating the old levee, constructing an 8-foot-high by 2-foot-wide concrete floodwall, and placing and compacting a 5-foot-high earthen slope (screening) along both sides of 3,700 feet of the new floodwall. This earthen slope is intended to reduce the visual effects of the floodwall, as well as discourage graffiti, since only the upper 3 feet of the floodwall would be visible. The remaining 600 feet of floodwall (station 4+00 to 10+10) would not have earthen slopes to minimize the effects to nearby large oak trees. During construction, a 50- to 60-foot-deep by 2-foot-wide slurry wall would be installed beneath the new floodwall to prevent piping of foundation materials and control seepage into the residential area during high flows.

To ensure access for floodwall inspection and maintenance activities, the design would include a 10-foot-wide, vegetation-free road along the waterside base of the new earthen slope. A 20-foot-wide area would also be included on the landside to allow inspection during high flows. Once construction is completed, the new earthen slopes would be revegetated using a grass mixture minimize soil erosion.

While this alternative would have less effect on land use and vegetation than a new levee because of the smaller construction footprint, a continuous floodwall would have adverse visual effects and interfere with recreational access to the Parkway. Local residents also expressed concerns about the potential for graffiti. In addition, the cost of constructing this length of floodwall would be very high as compared with other alternatives. As a result, this alternative was not considered further although sections of floodwall are considered in other alternatives.

3.2 ALTERNATIVES STUDIED IN DETAIL

The alternatives studied in detail include the no action alternative, also known as the “no project” alternative under CEQA. All of the action alternatives would involve modifying approximately 4,300 feet of levee from the Mayhew Drain upstream to where the levee ties into high ground. The levee above that point does not need to be reconstructed because the ground is higher than the 160,000-cfs design water-surface elevation.

Each action alternative would reduce potential damages and loss of life by ensuring safe containment of flows in the American River up to 160,000 cfs, while addressing seepage under the levee during high flows. In particular, about 300 homes, property, and infrastructure in the adjacent residential area would have a reduced risk of flooding.

3.2.1 Alternative 1 – No Action

Under this alternative, the Federal Government would take no action to reconstruct the levee in the project area. The levee would remain in its present condition. It would not meet Corps engineering standards and would not be part of the Federal levee system. The levee would also continue to provide a relatively low level of flood protection to the residents in and near the project area.

3.2.2 Alternative 2 – Standard Corps Levee with Screened Floodwall (5+50 to 10+00)

Features

This alternative would involve replacing approximately 450 feet of existing levee with a screened floodwall and reconstructing the remaining 3,850 feet of levee to meet Corps engineering standards. Details of the work are shown on Plates 3 and 4.

The work would include excavating portions of the old levee; constructing a 450-foot section of 8-foot-high by 2-foot-wide concrete floodwall; placing and compacting a 5-foot-high earthen slope along both sides of the new floodwall; and then realigning, recontouring, and raising the remaining 3,850 feet of the levee to 8 feet by adding and compacting fill material. During construction, a 50- to 60-foot-deep by 2-foot-wide slurry wall would be installed beneath the new levee and floodwall to prevent piping of foundation materials that could trigger a failure of the structure.

The new section of floodwall would extend from near the end of Tucumcari Way upstream about 450 feet (station 5+50 to station 10+00). The ends of the new floodwall section would transition into the new levee. The new levee would be 8 feet high and have a 2H:1V landside slope and 3H:1V waterside slope. The levee crown would be 20 feet wide and covered in aggregate base material.

Where the levee transitions into the floodwall, access ramps from the waterside to the landside and back to the waterside maintenance road would be constructed to provide maintenance access. The ramps would not be constructed to Americans with Disabilities Act standards because the ramps would be for maintenance only and would not provide access for the general public. The ramps would be constructed of fill material and covered with aggregate base material.

To ensure access for levee and floodwall inspection and maintenance, the design would include a 10-foot-wide, vegetation-free road along the base of the new earthen and levee slopes on the waterside. A 10-foot-wide area would also be included on the landside to allow inspection during high flows. Once construction is completed, the earthen slopes and levee slopes would be revegetated using a native seed mixture to minimize soil erosion.

The Kansas Way access would be constructed to match the new top of levee and to provide access for emergency vehicles. Gates or bollards would be placed at the foot of the ramp to control unauthorized vehicle access.

Construction Details

Access and Staging. Prior to the levee work, temporary roads and ramps would be constructed from the levee crown to provide access for construction equipment, materials, and worker vehicles to the staging and work areas. An access road would be constructed from the existing levee crown at the upstream end of the project to the Gristmill Park road to form a turnaround for construction vehicles. Ramps would be constructed from the levee crown down to the staging area, and 20-foot-wide turnouts would be constructed on the levee crown to allow two-way construction traffic along the top of the levee. The large potholes and pits in the Gristmill Park road would be filled to make the road useable by large equipment and haul trucks.

Once this work is completed, the contractor would transport construction equipment and materials to the staging areas via regional roadways and neighborhood streets. Types of equipment would include an excavator, bulldozer, grader, compacter, water trucks, haul trucks, and a slurry batch plant. Space for worker parking would also be provided, as well as an area for temporary stockpiling of excavated material for later reuse and a temporary construction office (trailer).

Site Preparation. The levee work would likely be conducted at both the upstream and downstream ends of the project at the same time in order to complete the work as quickly as possible. Levee work at each end would begin by preparing the work area. This would first involve identifying and protecting specific trees and other sensitive vegetation that could be affected by the work. Then other trees and shrubs in the construction footprint would be transplanted or removed, and the top 6 inches of grassy vegetation, debris, and soil would be stripped from the ground surface. All of this material would be removed offsite and disposed of at an appropriate landfill in the area.

Infrastructure and Utilities. A stormwater pumping station is located along the landside of the levee at the western end of the project. The fenced, underground station is operated by Sacramento County, which identified the station as “D6.” The station pumps stormwater from the local residential streets into the American River (Mutschler pers. comm., 2005). The discharge lines from the stormwater pumping station would be removed prior to construction and then replaced after completion of construction. Conditions are expected to remain dry during construction; however, the Corps would require the contractor to provide temporary pumping and removal of stormwater.

A sewage lift station is located adjacent to the levee at the north side of Mira Del Rio and Stoughton Way. This fenced, underground station receives sewage from the north side of the river and conveys it to the Sacramento County Regional Sanitation District system for treatment. Unlike the stormwater pump station outfall pipes, the sewer pipes crossing the levee need to remain in service. These pipes are expected to be shallow enough that the slurry wall can be constructed around them while they are still active.

Construction Activities. Once the area is cleared and utilities are relocated, the entire existing levee would be excavated, and the soil would be temporarily stockpiled. Prior to construction of the new floodwall and levee, the slurry wall would be installed from ground level to a depth of 50 to 60 feet. This would be accomplished by digging a trench, stockpiling the excavated soil material, and then filling it with a mixture of the soil material, cement, and bentonite using the slurry batch plant housed in the staging area. Even though the depth to groundwater is 29 to 37 feet in the project area, a dewatering plan would not be needed because the slurry would prevent the trench from collapsing when groundwater is encountered (Mulder pers. comm., 2005b).

Once the slurry wall is installed, the section of new 8-foot concrete floodwall from station 5+50 to station 10+00 would be constructed using a cast-in-place method. This would involve erecting a wooden frame around rebar reinforcement and placing concrete into the frame to form a vertical segment of the floodwall. This would be repeated until the entire floodwall is formed. The ends of the new floodwall would transition into the adjoining levee to ensure access for maintenance and structural stability. Maintenance access ramps would be installed on both ends of the floodwall so that vehicles can transition from the waterside maintenance road to the landside and back.

Once the floodwall is formed, stockpiled soil material would be reused to screen the lower 5 feet of both sides of the floodwall. The height of the soil against the floodwall would vary to minimize encroachment toward the large oak trees in the vicinity. The earthen screen would be shaped, compacted, and seeded with grasses to minimize erosion. This screening would be for visual purposes only; that is, it would not be designed to provide flood protection.

Concurrently, the remaining section of existing levee would be reconstructed with a 10-foot landside maintenance road. This would involve filling, shaping, and compacting the soil material while raising the height of the levee to 8 feet. The stockpiled material would be reused in the reconstruction, and additional fill material would be imported from commercial sources, as needed. The levee design would incorporate a 2H:1V landside slope, 3H:1V waterside slope, and 20-foot-wide levee crown. Construction methods would be in accordance with Corps engineering standards for flood control levees.

Once the levee is reconstructed, a 10-foot-wide vegetation free zone would be constructed along the base of the new earthen levee slopes on the waterside. This road, which would be unpaved and kept vegetation-free, would be used for regular inspection and maintenance activities. The design would also include a 10-foot-wide maintenance area on the landside to allow inspection and flood fight activities during high flows.

Restoration and Clean Up. Once the levee work is completed, all equipment and excess materials would be transported offsite via neighborhood streets and regional highways. The barren earthen and levee slopes would be reseeded with native grasses to promote revegetation and minimize soil erosion. The temporary roads, access ramps, and the Gristmill Park parking lot (staging area) would also be restored to pre-project conditions and reseeded. The other two staging areas would be reseeded and planted with small trees and shrubs. Finally, the work sites and staging areas would be cleaned of all rubbish, and all parts of the work would be left in a safe and neat condition suitable to the natural and recreation setting of the Parkway.

Construction Management

The contractor would be required to implement construction management plans including a spill prevention and response plan, an erosion and sediment control plan, and a stormwater pollution prevention plan. These plans would include the following requirements:

Spill Prevention and Response Plan

- Properly store any hazardous materials.
- Refuel equipment and vehicles only in a designated part of the staging areas where potential spills can be readily contained.
- Check and maintain equipment and vehicles to prevent leaks of fuels, lubricants, and or other fluids.
- Clean up any spills of hazardous material immediately. Spills would be reported in construction compliance reports.

Erosion and Sediment Control Plan

- Conduct construction work according to site-specific construction plans that minimize the potential for sediment to enter the American River, Mayhew Drain, or storm drainage.
- Identify, with construction fencing, all areas that require clearing, grading, revegetation, or re-contouring, and minimize the extent of areas to be cleared, graded, or re-contoured.
- Grade stockpile areas to minimize surface erosion, and apply erosion control measures, as appropriate, to prevent sediment form entering the river or drain.
- Apply mulch to disturbed areas, as appropriate, and plant with appropriate plant species as soon as practical after disturbance.

Storm Water Pollution Prevention Plan

- Install silt fences along the edge of the work zones along the American River and Mayhew Drain to prevent silt and sediment from entering the two waterways.
- Stabilize and reseed with native grasses all soils and exposed areas disturbed by construction

Staging and Stockpiles Areas

Staging Areas. Three staging areas would be used during construction of the project. The contractor would use these staging areas to park construction equipment and worker vehicles, store materials and supplies, and maintain temporary office space (trailer). Types of equipment would include an excavator, bulldozer, grader, compacter, water trucks, and haul trucks. The staging areas would also house the slurry batch plant and other equipment needed to install the slurry cutoff wall.

The three staging areas would be located in the Parkway on the waterside of the existing levee. The locations of these three areas are shown on Plate 5. The first staging area would be the triangle of open space located between the Gristmill Park road and the levee on the upstream end of the Gristmill Park entrance. Vegetation in the area includes mostly nonnative trees and grasses that would need to be removed.

The second staging area would be approximately 1.2 acres of open space across the levee from the Kansas Way and Mira Del Rio Drive intersection. The area is approximately 400 feet long by 130 feet wide. The waterside limits of the staging area vary because it follows the alignment of the lower walking path closest to the river. The area is currently covered with nonnative grasses and one large elderberry shrub that would be protected in place. A few scattered shrubs and a few trees are also located on the parcel.

The third staging area is located at the west end of the project between stations 2+60 and 4+70. The area is a modified L-shape and would be approximately 0.2 acres of open space. It provides a location for trucks to turn around, if necessary, and is adjacent to the Mayhew Drain access point. Vegetation includes mostly grasses.

Stockpile Areas. Construction of the levee and floodwall, as well as installation of the slurry wall, would involve excavation and reuse of existing levee and soil material. All earthen fill material generated onsite would be reused to the maximum extent feasible in order to minimize truck trips, noise, exhaust emissions, and project costs. Prior to reuse, this excavated material would be temporarily stockpiled in one of the three staging areas. All stockpile areas would be surrounded by filter fence to ensure containment of the excavated material during rainfall.

The levee and floodwall work would result in approximately 8,850 cubic yards of levee cut material. This material would be reused in constructing the levee and screening the new floodwall. The slurry cutoff wall would result in approximately 6,650 cubic yards of excavated soil material, which would be mixed with bentonite to form the slurry for the cutoff wall. Any unsuitable soil material would be disposed offsite.

Borrow and Disposal Sites

The Mayhew Levee project would involve transport of both borrow and disposal material to and from the project area. Borrow material would include approximately 34,750 cubic yards of soil fill material for the new levee, 700 cubic yards of concrete for the floodwall, and 670 cubic yards of aggregate base material for the top of the new levee. These materials would be obtained from commercial sources located within 10 miles of the project. Truck haul routes would depend on the locations of the commercial sources, but are assumed to include Mira Del Rio Drive, Linda Rio Drive, Stoughton Way, Butterfield, Folsom Boulevard, and other roadways.

Types of disposal material would include of the top 6 inches of soil (5,100 cubic yards), vegetation including trees and shrubs, and fences. This material would become the property of the construction contractor, who would be required to dispose of the material at an appropriate commercially licensed disposal site such as the Kiefer Landfill or Florin-Perkins Landfill. Truck haul routes would depend on the location of disposal site, but are assumed to include Mira Del Rio Drive, Linda Rio Drive, Stoughton Way, Butterfield, Folsom Boulevard, and other roadways within 10 miles of the project area.

Construction Workers and Schedule

The work would require approximately 20 workers per day to direct the project, operate construction equipment and haul trucks, and provide traffic management and safety. These workers would access the project vicinity via major roadways such as Interstate 50 to Folsom Boulevard, use Mira del Rio Drive and Butterfield to enter the residential area, and access the staging and work areas via the Gristmill Park entrance and existing levee crown.

Work would be limited to daylight hours between the hours of 6:00 a.m. and 8:00 p.m. on weekdays and 7:00 a.m. to 8:00 p.m. on Saturday. Sunday work will be limited to 7:00 a.m. to 8:00 p.m. and would involve truck maintenance and slurry trench stabilization activities only. No work would be done at night. Construction of the project is scheduled to begin in February 2007, at which time elderberry shrubs and oak trees would be transplanted. Levee construction would begin in May and be completed by November within one construction season. Construction is estimated to take approximately 6 months.

Operation and Maintenance

Constructed by local interests, the existing levee does not meet Corps engineering standards and thus is not part of the Federal American River Project, which is maintained by the American River Flood Control District. Instead, the levee is operated and maintained by Sacramento County. Regular maintenance activities include clearing vegetation on the levee, removing trash, and repairing the gate, as needed. Access is via the existing levee crown.

Once construction is completed, responsibility for the project would be turned over to the Reclamation Board, the non-Federal sponsor for the project. This would include operation, maintenance, repair, rehabilitation, and replacement of all project features. The Reclamation Board would convey these responsibilities to SAFCA. It is anticipated that SAFCA would contract with the American River Flood Control District to operate and maintain the levee. Regular maintenance activities would include mowing and spraying levee slopes, controlling rodents, clearing the maintenance road, and inspecting the levee and floodwall.

In case of high water, the floodwall height could not be reliability raised using sand bags, a method which can be used on earthen levee sections. Use of sand bags at the floodwall section would block the levee patrol road. An alternative patrol road would not be available due to the residential development in the project area. Because of the inability to temporarily raise the floodwall section, flood fighting at the floodwall section would be limited to constructing a temporary emergency spillway with sandbags and plastic sheeting landside of the floodwall so that overtopping flows would not significantly erode the levee embankment.

3.2.3 Alt 3 – Standard Corps Levee with Screened Floodwall (0+00 to 10+00)

Features

The features would be the same as Alternative 2 except that Alternative 3 would involve replacing approximately 1,000 feet of existing levee a with screened floodwall and reconstructing the remaining 3,300 feet of levee to meet Corps engineering standards. The new larger section of floodwall would extend from the end of the project near the Mayhew Drain gate upstream approximately 1,000 feet (station 0+00 to station 10+00). Details of the work are shown on Plates 6 and 7.

Construction Details and Management

The details of construction and contractor requirements would be the same as Alternative 2.

Staging, Stockpile, Borrow, and Disposal Areas/Sites

The staging and stockpile areas would be the same as Alternative 2. The levee and longer floodwall work would result in approximately 5,100 cubic yards of levee cut material. The borrow and disposal sites would be the same as Alternative 2 except that less soil fill material and more concrete would be needed due to the longer floodwall. Borrow material would include 25,900 cubic yards of soil fill material for the new levee, 1,500 cubic yards of concrete for the floodwall, and 670 cubic yards of aggregate base material for the top of the new levee. Removal of the top 6 inches of soil would result in approximately 5,100 cubic yards of disposal material.

Construction Workers, Schedule, Operation, and Maintenance

The construction workers, access routes, and schedule would be the same as Alternative 2. Operation and maintenance would be the same as Alternative 2.

3.2.4 Alt 4 – Non-standard Levee with Screened Floodwall (5+50 to 10+00)

Features

The features would be the same as Alternative 2 except that Alternative 4 would involve reconstructing 3,850 feet of levee with a steeper waterside slope than proposed by Corps engineering standards. Specifically, the new levee would have a 2H:1V rather than a 3H:1V waterside slope. Construction of the 450-foot floodwall would be the same as Alternative 2. Details of the work are shown on Plates 8 and 9.

Construction Details and Management

The details of construction would be the same as Alternative 2 except that the waterside slope of the levee would be 2H:1V instead of 3H:1V. Without additional measures, an increased risk of surface sloughing following rapid drawdown after a high water event and increased erosion could occur with this design. To compensate for these increased risks inherent in this design this alternative would require use of soil material meeting more stringent design standards that allow for a higher compaction rate, installation of geotextile material extending back from the waterside slope, and placement of engineered rock along the surface of the waterside slope. The rock would then be covered with 6 inches of soil and seeded with grasses. The design would pass a single event 160,000-cfs floodflow with at least 3 feet of freeboard between the water-surface elevation and the top of the levee. The contractor requirements would be the same as Alternative 2.

Staging, Stockpile, Borrow, and Disposal Areas/Sites

The staging areas would be the same as Alternative 2. The stockpile areas would also be the same as Alternative 2 except that the non-standard levee and floodwall work would result in approximately 5,100 cubic yards of levee cut material. The borrow and disposal sites would be the same as Alternative 2 except that less soil fill material would be needed due to the non-standard levee. Borrow material would include 24,400 cubic yards of soil fill material for the new levee, 700 cubic yards of concrete for the floodwall, and 670 cubic yards of aggregate base material for the top of the new levee. Removal of the top 6 inches of soil would result in approximately 5,100 cubic yards of disposal material.

Construction Workers, Schedule, Operation, and Maintenance

The construction workers, access routes, and schedule would be the same as Alternative 2. Constructed by local interests, the existing levee does not meet Corps engineering standards and thus is not part of the Federal American River Project, which is maintained by the American River Flood Control District. Instead, the levee is operated and maintained by Sacramento County. Regular maintenance activities include clearing vegetation on the levee, removing trash, and repairing the gate, as needed. Access is via the existing levee crown.

Once construction is completed, responsibility for the project would be turned over to the Reclamation Board, the non-Federal sponsor for the project. This would include operation, maintenance, repair, rehabilitation, and replacement of all project features. The Reclamation Board would convey these responsibilities to SAFCA. It is anticipated that SAFCA would contract with the American River Flood Control District to operate and maintain the levee. Regular maintenance activities would include mowing and spraying levee slopes, controlling rodents, clearing the maintenance road, and inspecting the levee and floodwall.

Levee maintenance could be more difficult with this alternative than with alternatives using a standard Corps levee design. Visual inspection of the levee would be less effective because internal damage might be hidden by the rock and soil cover over the geotextile material. The presence of geotextile materials over each 18-inch lift of soil along with the rock overlayer would complicate any needed repairs. If emergency repairs are needed during or just after a high water event, equipment access on the waterside of the levee might not be available due to ground saturation. Finally, although seepage below the existing ground level would be minimized by the slurry cutoff wall included in the design of all of the alternatives, the steeper waterside slope of the 2H:1V design subjects the levee slope to greater head pressure from the flow of water in the channel. This pressure, along with the narrower prism of the levee, would create a slightly shorter seepage pathway through the levee than the 3H:1V standard design. If maximum channel flows were maintained for a prolonged period, the head pressure could lead to excessive seepage that would result in piping of water through the levee. This could ultimately result in levee failure.

3.2.5 Alt 5 – Non-standard Levee with Screened Floodwall (0+00 to 10+00)

Features

The features would be the same as Alternative 3 except that Alternative 5 would involve reconstructing the 3,300 feet of levee with a steeper waterside slope than anticipated by Corps engineering standards. The floodwall would extend from station 00+0 upstream about 1,000 feet (station 0+00 to station 10+00). The new levee would have a 2H:1V rather than a 3H:1V waterside slope. Construction of the 1,000 foot floodwall would be similar to Alternative 3. Details of the work are shown on Plates 10 and 11.

Construction Details and Management

The details of construction and use of geotextiles would be the same as Alternative 4. The contractors requirements would be the same as Alternative 2.

Staging, Stockpile, Borrow, and Disposal Areas/Sites

The staging areas would be the same as Alternative 2. The stockpile areas would also be the same as Alternative 2 except that the non-standard levee and longer floodwall work would result in approximately 8,850 cubic yards of levee cut material. The borrow and disposal sites would be the same as Alternative 2 except that more concrete would be needed due to the longer floodwall. Borrow material would include 16,000 cubic yards of borrow soil material for the new levee, 1,500 cubic yards of concrete for the floodwall, and 670 cubic yards of aggregate base material for the top of the new levee. Removal of the top 6 inches of soil would result in approximately 5,100 cubic yards of disposal material.

Construction Workers, Schedule, Operation, and Maintenance. The construction workers, access routes, and schedule would be the same as Alternative 2. Operation and maintenance would be the same as Alternative 4.

3.2.6 Alt 6 – Standard Corps Levee with No Floodwall

Features

The features would be the same as Alternative 2 except that Alternative 6 would involve reconstructing the entire 4,300 feet of levee to meet current Corps engineering standards. There would be no sections of floodwall. Details of the work are shown on Plates 12 and 13.

Construction Details and Management

The details of construction would be the same as Alternative 2, but without the floodwall. The contractor requirements would be the same as Alternative 2.

Staging, Stockpile, Borrow, and Disposal Areas/Sites

The staging areas would be the same as Alternative 2. The stockpile areas would also be the same as Alternative 2 except that the levee work would result in approximately 4,600 cubic yards of excavated soil material. The borrow and disposal sites would be the same as Alternative 2 except that no concrete would be needed without the floodwall. Borrow material would include

42,000 cubic yards of soil fill material for the new levee and 670 cubic yards of aggregate base material for the top of the new levee. Removal of the top 6 inches of soil would result in approximately 5,100 cubic yards of disposal material.

Construction Workers, Schedule, Operation and Maintenance

The construction workers, access routes, and schedule would be the same as Alternative 2.

Because there is no floodwall, the maintenance activities and cost would be less. In case of high water, the levee height would be raised using sand bags at the waterside edge of the levee crown and the maintenance road would be clear for emergency vehicles.

3.3 PUBLIC REVIEW AND COMMENT

The draft EIS/EIR for the Mayhew Levee project was completed and distributed for public review and comment in November 2005. The draft document evaluated the potential environmental effects of the five alternatives to raise and improve the levee in the project area. Numerous written comments were received during the 45-day public review period. The commentors included the following:

U.S. Department of Interior
U.S. Environmental Protection Agency
Governor's Office of Planning and Research
State Department of Water Resources
The Reclamation Board
Sacramento County Department of Regional Parks, Recreation, and Open Space
Save the American River Association, Inc.
Butterfield-Riviera East Community Association
Ms. Kelly Cohen
Mr. Charles S. Mifkovic
Mr. Richard Smith
Mr. Ray Willis

In addition, public comments were recorded during several meetings and a public hearing:

Public meeting held on December 13, 2005
Public hearing held on December 15, 2005
Minutes of Reclamation Board meeting held in December 2005

Many of the comments focused on two of the significant issues raised earlier and considered throughout the planning process. These issues included (1) adverse effects on mature oak trees along the existing levee and (2) loss of acreage in the Parkway due to the levee design. Other issues involved esthetics of the floodwall, recreation access and use, flood protection for the community, and construction effects on the local residents.

4.0 REFINEMENT OF ALTERNATIVES

After further discussion with other agencies and local groups, the Corps and the non-Federal sponsor decided to reconsider the various alternative designs in the November 2005 EIS/EIR and make refinements, if possible, to address the following issues raised in the comments. However, all refinements would need to meet the Corps and FEMA criteria and standards related to levee construction and vegetation management on levees and floodwalls to ensure the integrity and functioning of the flood control structure.

4.1 FLOODWALL LENGTHS

4.1.1 Public Concerns

Questions were raised regarding the (1) need for a 1,000-foot-long floodwall when a shorter length would adequately protect the three mature oak trees and (2) use of shorter sections of floodwall to protect individual oak trees.

4.1.2 Technical Analysis

Originally, the 1,000-foot floodwall length was proposed to try and preserve some elderberry shrubs and ease the transition from the floodwall to the standard levee. However, the U.S. Fish and Wildlife Service subsequently determined that the shrubs would need to be relocated in any case. As a result, the Corps reconsidered the length of floodwall needed to adequately protect the three mature oak trees and determined that a 700-foot length would provide the necessary protection.

The Corps also reconsidered using shorter sections of floodwall to protect individual oak trees instead of the 450-foot floodwall. This would reduce costs while still protecting the individual oak trees. A subsequent refined design included a 232-foot-long floodwall to protect trees #8 and #10, and a 109-foot-long floodwall to protect tree #7.

4.1.3 Conclusions and Refinements

Since additional analysis has indicated that the 1,000-foot-long floodwall would provide no additional benefits than a shorter floodwall, the floodwall length in Alternatives 3 and 5 has been reduced to 700 feet. In addition, the 450-foot floodwall design in Alternatives 2 and 4 has been modified to include a 232-foot-long floodwall to protect trees #8 and #10, and a 109-foot-long floodwall to protect tree #7.

4.2 MATURE OAK TREES

4.2.1 Public Concerns

Questions continued to be raised regarding preserving the three mature oak trees (#7, #8, and #10) along the waterside of the existing levee.

4.2.2 Technical Analysis

Design Criteria and Standards

EM 1110-2-301. The two technical issues related to trees/woody vegetation and flood control structures are access and seepage.

Access. As shown on Figures 3-1 and 3-2 in the EM, a vegetation-free zone adjacent to the floodwall to allow access for flood-fighting, periodic and emergency inspections, and maintenance. Only sod-forming grass of 2 to 12 inches in height is permitted in the vegetation-free zone. The extent of the vegetation-free zone must coincide with the root-free zone on the landside of the flood control structure and must extend 8 feet beyond the heel of the structure on the waterside. The critical issue with the vegetation-free zone is access.

Seepage. As shown on Figures 3-1 and 3-2, a root-free zone is also required adjacent to the flood control structure to protect the integrity of a toe drain, to minimize surface water penetration, and to prevent loosening of the soil. Woody roots clearly enhance the formation of macro-porosity in the soil, which may develop into soil pipes that are detrimental to the integrity of an earthen embankment/foundation. The root-free zone must extend 8 feet beyond the toe (or toe drain) of the flood control structure. The critical issue with the root-free zone is seepage, and ultimately satisfactory performance of the structure.

FEMA 534. The root system of trees and woody vegetation have two primary components: a rootball and a lateral transport root system. The rootball extends directly below the trunk, and the lateral transport root system extends well beyond the drip line (canopy) of the tree. In Chapter 3, Table 1, page 3-5, of FEMA 534, typical diameters for the rootball and the lateral transport root system are provided for various tree sizes. Subsequently, the trunk size of the oak trees need to be verified, and the corresponding rootball and lateral transport root system diameters determined from Table 1 of FEMA 534. The oak trees must be far enough away from the flood control structure that neither the rootball nor the lateral transport root system is within the 8-foot root-free zone. For example, for a tree diameter of 10 to 11 inches (root system diameter equals 26 to 28 feet), the tree must be at least 14 feet away from the root-free zone or 22 feet away from the toe (or toe drain) of the flood control structure.

Root-Free Zone

Criteria and standards in EM 1110-2-301 and FEMA 534 were used to calculate the approximate distances that would be needed between the mature oak trees and the nearest flood control structure (levee or floodwall) to determine the potential effects of the trees on the integrity of the structure. These criteria include a root-free zone of 8 feet from the levee toe (EM), as well as root system radii based on tree diameter (FEMA). Results of the calculations indicated that all three trees are located within their respective effect zone. Failure of the trees may adversely affect the integrity of the flood control structure. Strict interpretation of these criteria indicates removal of all three trees.

Root Barrier

The use of a root barrier was evaluated as a possible measure to ensure the integrity of the slurry wall from the invasion of roots from the mature oak trees. Such a barrier would allow the three mature oak trees to remain within the root-free zone. However, because of the proximity of the trees to the floodwall, installation of a root barrier would require cutting the roots and damaging the tree. How much the roots are cut and how much the tree is damaged depends on the distance of the tree from the floodwall (see Appendix B, Tree Associates Reports). The depth of a root barrier to be sufficiently effective was estimated by arborists at Tree Associates to be 10 feet below ground surface. Although EM 1110-2-301 and FEMA 534 do not discuss use of a root barrier of a type that would be needed for this project, various methods were considered, including chemical and physical barriers.

The use of chemical barriers was considered to ensure the viability of the slurry wall from the invasion of roots from the mature oak trees. Applications of a chemical to the slurry wall may have unknown detrimental effects to the subsurface environment near the slurry wall. It is uncertain whether a chemical barrier would be supported by the Corps. Additional information regarding the environmental effects would need to be evaluated. For a physical barrier, the root barrier would be made out of an impervious material such as grout, sand, or plastic barrier, or plastic or sheet piling. Depending on the material, the barrier could be installed by cutting a trench with a small ditch witch or driving the barrier into place.

The potential environmental effects of installing a root barrier would include need to trim the trees to ensure sufficient vertical clearance for machinery to make a trench; disturbance of animals, especially subterranean, if the barrier is required to be driven into place; and adverse effects to root systems of mature oak trees.

4.2.3 Conclusions and Refinements

To protect the slurry wall from invasion of roots, the designs of Alternatives 2, 3, 4, and 5 were refined to include a physical root barrier between the mature oak trees and the slurry wall on the waterside. This would ensure the integrity and proper functioning of the flood control structure. Only Alternative 6 would not require such a root barrier.

4.3 LEVEE EROSION CONTROL

4.3.1 Public Concerns

Questions continued to be raised regarding using geogrids in association with a non-standard 2H:1V waterslope levee slope to control erosion. In addition, requests were also made that the use of Pyramat also be considered with the non-standard slope to control erosion.

4.3.2 Geogrids

The potential use of geogrids with a non-standard 2H:1V waterside levee slope to control erosion was initially evaluated during development of the alternatives. As discussed in Section

2.4.5, geogrids with an overlying layer of engineered rock was determined to be the most feasible of several possible designs and was included as part of Alternatives 4 and 5.

Because of the continued discussion related to a 2H:1V waterside levee slope, however, the Corps researched additional applications of geogrids to control erosion. Research showed that the performance of geogrids on the Sacramento River has proved to be less than satisfactory and that successful applications all appeared to be for incised channels or storage ponds, not levees. In addition, the geogrid at Mayhew would be buried very shallow, thus subject to exposure by foot traffic and animal use. This would lead to more frequent maintenance and additional problems with maintenance and repair of the geogrid material. As a result, the use of geogrids is still not supported by the Corps.

4.3.3 Pyramat

The potential use of Pyramat instead of geogrids was evaluated to control erosion on the non-standard 2H:1V waterside levee slope. Pyramat, a high performance turf reinforcement mat, is rolled onto the embankment surface and secured with anchors in a checkerboard pattern. A thin layer of fertile soil is then placed over the secured Pyramat to encourage vegetation growth. Pyramat can also be used in conjunction with methods such as rock riprap and articulated concrete blocks to prevent scour protection at the toe of the embankment.

Both Propex, the manufacturer, and users were contacted for information on Pyramat. According to the manufacturer, this product has been used in shortline/embankment protection, flood control channel, inlet/outlet protection, slope protection, roadway shoulders, and dune/wave attack protection. The product is not recommended for continuous flow channels and environments with unfertile soil since vegetation growth through the mat is needed to ensure optimum functioning of the Pyramat.

To date, Pyramat has never been used in a Corps levee or any other type of Corps project. In the Sacramento area, the American River Flood Control District has a test site of Pyramat on the waterside slope of the Sacramento River levee at the new waste treatment plant between Old Sacramento and Discovery Park. According to the District, the soil under the Pyramat has either settled or eroded, leaving cavities under the Pyramat (Corps, 2006). The District also expressed concern about placing the Pyramat on levees that require maintenance because the Pyramat could get caught in the grass mowers.

In 2005, Propex also retained GeoSyntec Consultants to perform field evaluations of existing Pyramat projects, including observing the condition of the Pyramat in channel applications and back-calculating flows from major rain events. Five locations in the Southeast were evaluated, and preliminary results were provided to the Corps. Data regarding Pyramat performance under grass and forest fire conditions was also provided. Appendix C includes memoranda, letters, and technical information about Pyramat and its uses.

Based on the manufacturer information and results of the test site, the Corps has concluded that there is insufficient evidence that demonstrates the long-term effectiveness and durability of

Pyramat. As a result, the Corps does not recommending implementing this product in any high risk Corps projects such as the Mayhew Levee (Corps, 2006).

4.3.4 Conclusions and Refinements

Because of uncertainties with effectiveness and potential problems with maintenance, the Corps does not recommend application of either geogrids or Pyramat to control erosion on the non-standard levees in Alternatives 4 and 5. As a result, no refinements were made to these alternatives. The standard Corps levees in Alternatives 2, 3, and 6 are not subject to the same risk of erosion.

5.0 REFINED ALTERNATIVES

Design refinements were made to the alternatives in the draft EIS/EIR within the same levee footprint based on the results of the public comments and subsequent additional technical studies. The main differences in the alternatives were the number and lengths of floodwall, addition of a waterside root barrier, and addition of a landside retaining wall/access road. The refinements in the alternatives are shown on Table 1. All other features, construction details, construction management, staging and stockpile areas, borrow and disposal sites, construction workers and schedule, and operation and maintenance would remain basically the same as the alternatives in the draft EIS/EIR.

Table 1. Design Refinements to Alternatives in DEIS/EIR

Alternatives	**DEIS/EIR**	**Refinements to Alternatives**
1 – No action	No action	No change
2 – Standard Corps Levee (3H:1V waterside levee slope)	450-foot screened floodwall No root barrier Surface-level landside access road at levee toe	232-foot and 109-foot screened floodwalls Waterside root barrier Landside retaining wall/ elevated access road cut into levee
3 – Standard Corps Levee (3H:1V waterside levee slope)	1,000-foot screened floodwall No root barrier Surface-level landside access road at levee toe	700-foot screened floodwall Waterside root barrier Landside retaining wall/ elevated access road cut into levee
4 – Non-Standard Levee (2H:1V waterside levee slope)	450-foot screened floodwall No root barrier Surface-level landside access road at levee toe	232-foot and 109-foot screened floodwalls Waterside root barrier Landside retaining wall/ elevated access road cut into levee
5 – Non-Standard Levee (2H:1V waterside levee slope)	1,000-foot screened floodwall No root barrier Surface-level landside access road at levee toe	700-foot screened floodwall Waterside root barrier Landside retaining wall/ elevated access road cut into levee
6 – Standard Corps Levee (3H:1V waterside levee slope)	4,500-foot standard levee	4,300-foot standard levee

Stations:
450-foot floodwall (5+50 to 10+00)
1,000-foot floodwall (0+00 to 100)
700-foot floodwall (2+10 to 9+10)
109-foot floodwall (3+40 to 4+49)
232-foot floodwall (6+78 to 9+10)

6.0 EVALUATION OF FINAL ALTERNATIVES

6.1 CRITERIA AND REGULATIONS

6.1.1 Corps of Engineers

The only refined alternative that meets the Corps' engineering standards for levees constructed as part of a Federally authorized flood control project is Alternative 6. Alternatives 4 and 5 with their steeper 2H:1V waterside slopes do not meet the standards in EM 1110-2-1913 because of the greater risk of levee erosion and surface sloughing at the 160,000-cfs design. Neither geogrids nor Pyramat has been proven to be an effective method to adequately prevent the increased levee erosion and sloughing. In addition, Alternatives 2 and 3 with their sections of floodwall do not meet the standards in EM 1110-2-301 because the proximity of the mature oak trees and their root systems diminish the integrity and functioning of both the slurry wall and floodwall.

6.1.2 Federal Emergency Management Agency

As detailed in 44 CFR 65.10, FEMA requires that levees be structurally sound, properly maintained, and have at least 3 feet of freeboard above the 100-year flood profile elevations before FEMA will recognize that the levees provide protection from the 100-year flood. The only refined alternative that meets FEMA's design criteria for certification is Alternative 6. Alternatives 4 and 5 with their steeper slopes do not meet the minimum criteria associated with embankment protection, and Alternatives 2 and 3 are not consistent with FEMA 534 because of the proximity of the mature oak trees and root systems.

6.2 TECHNICAL AND ENGINEERING FACTORS

6.2.1 Structural Integrity

Building two floodwalls, one to save each tree, would create four transition zones (concrete wall to earth levee). These transition zones are discontinuities at which potential seepage paths could develop due to uneven settlement and movement. A standard levee eliminates any discontinuity in the transitions between the levee and floodwall, and provides greater ease and uniformity for construction, flood fighting, and maintenance.

Although seepage below the existing ground level would be minimized by the slurry cutoff wall included in the design of all of the alternatives, the steeper waterside slope of the 2H:1V design subjects the levee slope to greater head pressure from the flow of water in the channel. This pressure, along with the narrower prism of the levee, would create a slightly shorter seepage pathway through the levee than the 3H:1V standard design. If maximum channel flows were maintained for a prolonged period, the head pressure could lead to excessive seepage that would result in piping of water through the levee. This could ultimately result in levee failure.

Preserving the trees would require installation of a root barrier to protect the floodwall and slurry wall. The root barrier would necessitate cutting the roots and canopies of the large mature oak trees adjacent to the levee, endangering the stability and life of the trees. Should the trees topple the integrity of the levee and/or floodwall would be compromised.

Clear zones at levee toes are needed for proper maintenance, inspection, flood fighting, and levee integrity. Trees, particularly the root systems, are detrimental to levee integrity. Old tree roots holes / stumps make preferential seepage paths and weak zones in the embankment and foundations that often lead to serious problems at high water. High winds often blow trees down causing ground rupture and damage. For these reasons, trees should be kept off and away from the levees.

6.2.2 Operation and Maintenance

Levee maintenance could be more difficult with Alternatives 4 and 5 than with alternatives using a standard Corps levee design. Visual inspection of the levee would be less effective because internal damage might be hidden by the rock and soil cover. The presence of geotextile materials over each 18-inch lift of soil along with the rock overlayer would complicate any needed repairs. If emergency repairs are needed during or just after a high water event, equipment access on the waterside of the levee might not be available due to ground saturation.

6.3 REAL ESTATE CONSIDERATIONS

In order to protect the mature oak trees while ensuring the integrity and functioning of the flood control structure, the footprint of the levee would have to extend landside into residential property for all of the alternatives (2-6). Taking of private property is unacceptable to the non-Federal sponsor and local community.

6.4 ENVIRONMENTAL CONSIDERATIONS

6.4.1 Vegetation and Wildlife Habitat

Trees, Shrubs, and Grassland

Cover Types. Vegetative cover types in the project area consist primarily of nonnative grassland and riparian oak woodland on the waterside of the levee. Scattered ornamental trees and shrubs are the primary vegetation on the landside toe of the levee. Nonnative grasses inhabit levee slopes, staging areas, and the woodland understory. Riparian oak woodlands are dominated by valley oak; interior live oak; and other riparian tree, shrub, and vine species. The riparian oak woodland also contains a large number of juvenile trees, primarily valley oak and interior live oak. These trees are mostly located directly adjacent to the waterside toe of the existing levee.

Effects. For all alternatives, vegetation removal would result in a substantial, short-term loss of native vegetation in the project area and vicinity. After construction is completed, all disturbed areas would be reseeded with native grasses and forbs. The project site is expected to have a complete grass and herbaceous cover within 1 year. The types of effects and significance on vegetation for all alternatives would be similar except that slightly less riparian oak woodland and grassland habitat would be removed with a floodwall and/or the 2H:1V levee slope than without a floodwall and/or the 3H:1V slope.

Mitigation. Suitable native trees and elderberry shrubs removed by the project would be replaced in the project vicinity at the proposed mitigation and restoration areas. Following construction, an additional 5 acres at the Kansas and Gristmill staging areas would be planted with native trees and shrubs. As a result, removed habitat would be replaced during the same year at more than a 2:1 ratio. Trees that cannot be replaced in the Mayhew flood plain would be replaced in one of four potential offsite mitigation areas, along with the mitigation required for effects to elderberry shrubs. The location of these replacement trees would be in compliance with the American River Parkway Plan. The four potential mitigation sites are (1) Lower Sunrise, (2) Sailor Bar, (3) Cal Expo, and (4) Goethe East.

Mature Oak Tree Health and Survival

Two arborist reports prepared for SAFCA by Tree Associates were used to evaluate the health of the three mature oak trees, as well as the potential effects of construction of the alternatives on the trees (SAFCA, 2001, 2003). When the data are extrapolated to the refinements to the design of Alternative 2, the proximity of the trees to the levee and the current health of these trees suggest that these trees would have only a moderate chance of survival at best (SAFCA, 2001).   Table 2 shows the distances, protection zones and chance of survival for the three mature oak trees.

Table 2. Distances and Protection Zones for Mature Oak Trees

Tree Number	Tree trunk distance from existing fence line	Distance of slurry wall from fence line for standard levee	Protection zone distance from trunk for low probability of decline	Protection zone distance from trunk for moderate probability of decline	Actual Distance of the Tree to the Slurry Wall	Chance of Tree Decline
7	70 feet	45 feet	37 feet	19 feet	23	Moderate
8	48 feet	45 feet	35 feet	18 feet	1	High
10	65 feet	45 feet	78 feet	39 feet	18	High

Source: SAFCA, 2001.

Other sources of damage to the trees include the equipment required to install the slurry wall in the levee and the root barrier needed to protect the slurry wall and floodwall from the tree roots. Installing these structures requires cutting the canopy and roots of the trees that damages the health of the trees, creating a greater possibility of toppling and damage to the floodwall and levee.

The transplanting of the elderberries between oak tree #10 and the levee would disturb the surface roots from approximately 1 to 8 feet deep. According to the arborist, the effect of the disturbance depends the extent of intermingling of elderberry roots and tree roots, and how much of the root ball would be removed. This tree root disturbance may affect the tree; visual indications may appear as soon as 2 years or as late as 50 years. The ability of the tree to survive would depend on how many roots are disturbed, as well as other issues such as drought and flood.

Wildlife

The riparian oak woodland in the project area provides high quality habitat for wildlife species while the nonnative grasses and trees on and near the existing provides lower quality habitat and inhibits the growth of native species. Types of wildlife include small mammals and numerous resident and migratory birds.

The wildlife in the Parkway is adapted to human presence because of the nearby urbanized area, recreational use, and inspection and maintenance activities. Construction activities and noise for all of the alternatives would disturb any nearby wildlife and cause them to move to other areas. However, most species would return to the area when construction is completed and the habitat has reestablished. For all alternatives, the removal of trees could result in the loss of nesting trees. However, removing trees in early March will reduce the risk of removing migratory bird and raptor nests.

6.4.2 Special Status Species

Species and Effects

Based on existing habitat and field surveys, the valley elderberry longhorn beetle (*Desmoceros californicus dimorphus*) is the only listed terrestrial species known to occur in the project area. Since no work would be conducted in or near the American River, none of the alternatives would affect the listed Sacramento splittail, Central Valley fall/late fall-run Chinook salmon, Sacramento River winter-run Chinook salmon, and Central Valley steelhead that are known to occur in the river.

Construction of all of the alternatives would directly and indirectly affect up to 116 elderberry plants, which is the host plant for the Federally listed valley elderberry longhorn beetle. To determine the effects, the Corps has initiated formal consultation with the FWS under Section 7 of the Endangered Species Act. According to the FWS, "if elderberry plants with one or more stems measuring 1.0 inch or greater in diameter at ground level occur on or adjacent to the proposed project site, or are otherwise located where they may be directly or indirectly affected by the proposed action, minimization measure which include planting replacement habitat are required."

Based on field surveys, the elderberry shrubs identified have approximately 300 stems measuring greater than or equal to 1.0 inch in diameter. Surveys completed over the last few years have concluded that many of these stems have exit holes and may be occupied by the beetle. As a result, all alternatives would directly and indirectly affect the habitat (elderberry shrubs) of the Federally listed valley elderberry longhorn beetle. This effect would be considered a significant effect on this special status species.

Mitigation

Mitigation for all alternatives would include transplanting all elderberry shrubs that physically can be transplanted, and establishing additional elderberry seedlings and associated natives according to the General Compensation Guidelines for the Valley Elderberry Longhorn Beetle dated July 9, 1999. Consultation with FWS has been initiated, and the Biological Opinion and Amendment will be included in the final EIS/EIR.

Prior to reconstruction of the levee, up to 116 clusters of elderberries would be transplanted to the 2 areas, totaling 5 acres in the Mayhew flood plain. This would be conducted at the same time that the oak trees are transplanted. An additional five associated native riparian species would be planted with each elderberry transplant. The transplant areas would be maintained (irrigated and weeded) for a minimum of 3 years pre-establishment period and longer if necessary to ensure the successful establishment of the plants. The site would be monitored for 10 years in accordance with the 1999 Guidelines.

Additional mitigation for the effects to the valley elderberry longhorn beetle would be planted within the four offsite mitigation sites as discussed in the final EIS/EIR. Based on the estimate of 116 transplants and 300 stems affected, mitigation is expected to be approximately 16 acres. These sites would be maintained for 3 years and monitored for 10 years in accordance with the 1999 Guidelines. This mitigation and monitoring would reduce the effects on the beetle to less than significant.

6.4.3 Wild and Scenic River

The Federal and State Wild and Scenic Rivers Acts require Federal and State agencies to exercise their authorities in a manner that preserves the free-flowing status of the lower American River and the values supporting the river's wild and scenic designation. None of the alternatives would encroach more than 23 feet into the floodway so the river would only come into contact with the levee during high flows. Extension of the waterside toe into the floodway would not significantly affect the direction or volume of river flow, divert any flow outside the existing channel, or obstruct the flow. Therefore, Federal agency participation in this work is fully consistent with their responsibilities under the Federal Wild and Scenic Rivers Act.

All of the alternatives satisfy the California Wild and Scenic Rivers Act. State agencies are only prohibited from constructing or assisting in the construction of projects that have an adverse effect on the free-flowing condition of a designated river. None of the alternatives would have such adverse effects. Moreover, the Legislature enacted the Urban American River Parkway Preservation Act in 1985 with full knowledge that the lower American River was a designated Wild and Scenic River. The Parkway Preservation Act specifically contemplated that State and local agencies would be operating and maintaining for flood control along the American River.

6.4.4 Environmentally Preferred and Environmentally Superior Alternatives

The NEPA and CEQA require identification of the environmentally preferred and the environmentally superior alternatives, respectively. Based on the environmental evaluation in the DEIS/EIR, Alternative 4 is considered to be the alternative that causes the least damage to the biological and physical environment, and protects, preserves, and enhances historic, cultural, and natural resources. However, from a CEQA perspective, this alternative is only minimally considered to be environmentally superior since it does not substantially reduce any of the project impacts. Alternative 4 would have the smallest footprint, use the least Parkway land, protect all three mature oak trees, and result in the fewest changes in esthetics but the overall effects related to loss of parkway land, short term loss of mature trees and esthetics impacts are still considered significant and avoidable, as with all other build alternatives analyzed. The non-standard design

(2H:1V waterside levee) would not be supported by the Corps because it would not meet the Corps and FEMA criteria and standards to ensure the integrity and functioning of the flood control structure.

6.5 SOCIAL CONSIDERATIONS

6.5.1 Esthetics

There continue to be concerns about the esthetics of a concrete floodwall along the Parkway. This structure would appear more manmade than an earthen levee seeded with native grasses. In addition, a floodwall would provide a surface for graffiti or vandalism. To minimize the manmade appearance, as well as surface for graffiti and vandalism, Alternatives 2 and 3 include screening the bottom 5 feet of floodwall with soil material seeded with native grasses. However, the top 3 feet of floodwall remain visible and accessible. Only Alternative 6 would maintain the same view of an earthen levee covered with native grasses.

6.5.2 Resident Petitions

In 2002 and 2006, residents of the Butterfield area circulated and signed petitions in support of the Corps design for an earthen levee that meets both Corps and FEMA criteria and standards. The 2002 petition specifically stated that "any concrete walls will become an eyesore, collect graffiti, hinder wild life, and prohibit those of us who own property along the levee access to the area." This petition included 200 signatures from residents and was provided to the Corps, SAFCA, County Supervisors, and American River Parks Commission.

The spring 2006 petition included 527 signatures from residents (424 adults) and was provided to the State Reclamation Board as the non-Federal sponsor for the project. The State's subsequent June 7, 2006, letter requesting that the Corps consider the residents' petition supporting for a standard levee is provided in Appendix D. This petition specifically stated:

"We, the undersigned homeowners, absentee owners, and tenants of absentee owners of Larchmont Butterfield, desire the Army Corps of Engineers, the State of California, the County of Sacramento, and the Sacramento Area Flood Control Agency to expedite the construction of a conventional levy [*sic*]which fulfills all the rules, regulations, and requirements of a federal levy [*sic*].

"We have patiently waited while environmental groups, both within and without our neighborhood, have put the well fair [*sic]* of the community on the same plane [*sic*] as the flora and fauna that occupy the strip of land between the American River and the inferior levy [*sic*] that now protects our community. Our families and our homes need to be protected from future flood disasters and by following federal levy [*sic]* guidelines, our flood insurance premiums will become a fraction of the amount we are paying now."

These petitions, as well as similar comments on the November 2005 EIS/EIR and at the public meeting and hearings, clearly indicate strong local support from many homeowners and residents for the Corps standard levee design for Federal levees.

6.6 PUBLIC SAFETY

6.6.1 Tree Toppling Risk

In the Sacramento area, high winds, saturated soil, and rising river water levels often happen simultaneously during severe storm events. Many local trees topple and uproot under these conditions. Such uprooting near floodwalls, levees, and slurry walls could open large craters, which could risk the integrity and functioning of the structure.

The Corps could neither guarantee the failure of trees due to the construction and maintenance of floodwalls or levees, nor guarantee the safety of the trees during a major flood event. Flow velocity is not considered to be significant along the Mayhew Levee during a flood event; however, a significantly weakened tree could be a liability if the project weakens the trees in or near inhabited areas.

During Hurricane Katrina, several large oak trees near the floodwall and levee protecting New Orleans toppled. Although not the primary cause of that failure, investigators concluded that the pulling action of the roots extruded earth plugs, further weakening the foundation. As a result, the Corps has evaluated the alternatives in light of levee and floodwall performance during Hurricane Katrina and has taken a firmer position for conformance to Federal levee construction regulations and standards.

6.6.2 Floodwalls

The 3-foot sections of exposed concrete floodwall could be a hazard to cyclists and pedestrians on the levee crown. The intermittent nature of the floodwall design, the waterside dropoff, and the inconsistent width of the levee crown/maintenance road could pose hazards to recreationists. In addition, the floodwalls could pose a safety risk if children or others walk, play or ride on the top of the walls. Jumping on or off the floodwall (on foot or bicycle) or accidental falls could result in injuries. The consistent earthen features of Alternative 6 would avoid this risk.

6.7 VIEWS OF NON-FEDERAL SPONSOR

The State Reclamation Board is the non-Federal sponsor for the Mayhew Levee project. Department of Water Resources staff have expressed support for construction of a standard Corps levee.

6.8 COSTS

The estimated costs for the final alternative plans are shown in Table 3. These estimates indicate that Alternative 6, the standard Corps levee design, is the least cost alternative. The selection of any other alternative would result in a minimum cost increase of $600,000.

6.9 SCHEDULE

The proposed schedule for the Mayhew Levee project is shown below. This schedule assumes that all outstanding issues are resolved and that the Federally recommended plan is selected for implementation. Since the Mayhew Levee work is a SAFCA priority because of the continuing risk of flooding, they support competing the project prior to the start of the flood season in 2007.

Federal Alternative Selection	August 2006
Final EIR Certification	End of 2006
Plans and Specifications	February 2007
Real Estate Acquisition	Early 2007
Final EIS Certification	Early 2007
Transplant Elderberries and Oaks	Feb 2007
Mitigation Site Planting	Spring 2007
Start Construction	Summer 2007
Construction Completed	December 2007

7.0 FEDERALLY RECOMMENDED PLAN

After reviewing the objectives, Corps engineering criteria, FEMA certification policy, and results of technical analysis, the Corps has determined that Alternatives 2, 3, 4, and 5 could not be certified for 100-year level of protection without the taking of private property on the landside of the levee. In order to protect the mature oak trees and meet Corps and FEMA requirements to ensure the integrity and functioning of the flood control structure, the footprint of the levee would have to be shifted landward into adjacent residential property. This landward shift would require the take of private property, which is unacceptable to the non-Federal sponsor and local community. As a result, the Corps has identified Alternative 6 with a standard Corps levee and removal of the mature oak trees as the Federally recommended plan.

8.0 REFERENCES

Code of Federal Regulations. Chapter 44, Section 65.10. Mapping of areas protected by levee systems.

Muntschler, Cary. 2005. Associate Engineer, Sacramento County Water Resources. Telephone conversation. August 29.

Sacramento Area Flood Control Agency (SAFCA). 2001. Tree Evaluation and Preservation Recommendations: American River Parkway – Gristmill Area. Prepared by Tree Associates. October 24.

Sacramento Area Flood Control Agency (SAFCA). 2003. 2nd Update of Construction Impact Evaluation and Tree Preservation Guidelines for Gristmill Trees #7, 8 and 10. Prepared by Tree Associates. July 12.

U.S. Army Corps of Engineers. 2000. Design and Construction of Levees. Engineer Manual 1110-1-1213. April 30.

U.S. Army Corps of Engineers. 2000. Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, and Embankment Dams. Engineer Manual 1110-2-301. January 1.

U.S. Army Corps of Engineers (Corps). 2006. Memorandum for Record, Subject: Preliminary Pyramat Research. Sacramento District, Sacramento, CA. March 15.

U.S. Federal Emergency Management Agency. 2005. Technical Manual for Dam Owners: Impacts of Plants on Earthen Dams. FEMA 534. September.

U.S. Water Resources Council (WRC). 1983. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. Washington, DC.

Table 3. Breakdown of Costs for Alternatives

MAYHEW LEVEE ALTERNATIVE PLANS
8/24/06

	ALTERNATIVE 1			ALTERNATIVE 2			ALTERNATIVE 3		ALTERNATIVE 4		ALTERNATIVE 5		ALTERNATIVE 6	
1. PLAN DESCRIPTION	No Action			Levee with 270 ft Floodwall and Tree Well. Levee with 3:1 Slope for 3,958 feet and floodwalls for 232 feet and 109 feet - slurry wall for 4,300 feet. Footprint and cross section of levee starting from property line, 10 ft O&M at landside toe, 2H:1V landside slope, 20 ft crown, 3H:1V waterside slope and 10 ft O&M at toe. Slurry wall beneath waterside top of levee hinge point.			Levee 3,600 feet and floodwall for 700 feet. Cross section of levee and slurry wall same as Alt. 2.		Levee 3,958 feet and floodwalls for 232 feet and 109 feet. Cross section of levee starting from property line, 10 ft O&M at landside toe, 2H:1V landside slope, 20 ft crown, 2H:1V waterside slope (with 2 ft thick rock and soil layer on face of waterside slope with geogrid and Pyramat) and 10 ft O&M at toe. Slurry wall length 4,300 feet beneath waterside top of levee hinge point.		Llevee 3,600 feet and floodwall for 700 feet. Same cross section and floodwall as Alt. 5. Slurry wall length 4,300 feet beneath vertical portion of wall.		Full standard levee 4,300 feet with no floodwall. Cross section of levee and slurry wall same as Alt. 2.	
COST [1]				**QUANTITY**	**UNIT**	**COST**	**QUANTITY**	**COST**	**QUANTITY**	**COST**	**QUANTITY**	**COST**	**QUANTITY**	**COST**
Clear Site and Grubbing				1.00	LS	27,600	1.00	31,200	1.00	27,180	1.00	26,760	1.00	36,000
6" Stripping (Disposal Material)				5,071.00	CY	31,694	5,071.00	31,694	5,071.00	31,694	5,071.00	31,694	5,071.00	31,694
Levee Fill Material				41,503.00	CY	492,848	40,526.00	481,246	33,512.00	418,900	34,011.00	425,138	46,427.00	464,270
Concrete Floodwall				506.00	CY	341,550	1,037.00	842,563	506.00	341,550	1,037.00	842,563	0.00	0
Slurry Wall (60')				216,000.00	SF	4,050,000	216,000.00	4,050,000	216,000.00	4,050,000	216,000.00	4,050,000	216,000.00	4,050,000
Cut & Fill Slurry Wall				13,407.00	CY	100,553	13,387.00	100,403	13,387.00	100,403	13,407.00	100,553	13,407.00	100,553
Aggregate Base				670.00	CY	41,875	670.00	41,875	670.00	41,875	670.00	41,875	670.00	41,875
24" Steel Sewer Mains				1.00	LS	15,000	1.00	15,000	1.00	15,000	1.00	15,000	1.00	15,000
30" Steel Pump Drain Pipes				1.00	LS	16,250	1.00	16,250	1.00	16,250	1.00	16,250	1.00	16,250
Grout 60" RCP				1.00	LS	21,250	1.00	21,250	1.00	21,250	1.00	21,250	1.00	21,250
Hydroseed Mix				4.40	AC	13,750	4.00	12,500	1.40	4,375	1.30	4,063	4.80	15,000
Geogrid				0.00	SY	0	0.00	0	39,600.00	1,386,000	36,000.00	1,260,000	0	0
Pyramat				0.00	SY	0	0.00	0	14,600.00	730,000	13,300.00	665,000	0	0
Landside Concrete Wall					LS	73,500								
Root Barrier					LS	65,000								
Subtotal						5,290,869		5,643,980		7,184,476		7,500,144		4,791,891

Mitigation [2]					LS	1,110,000		1,110,000		1,110,000		1,110,000		1,110,000
Real Estate [3]					AC	244,000		244,000		244,000		244,000		244,000
PE&D				1	LS	634,904	1	677,278	1	862,137	1	900,017	1	575,027
S&A				1	LS	449,724	1	479,738	1	610,680	1	637,512	1	407,311
Total (see footnote 3)						7,729,498		8,154,996		10,011,294		10,391,673		7,128,229

[1] Design has been stopped at about the 35% level and this is not a final or near final design and is therefore subject to revision as design proceeds.

[2] The mitigation cost of $1,110,000 is assumed the same for all 5 alternatives at this stage. This cost includes the lands cost for mitigation in the parkway only. If it is necessary to acquire lands locally outside the parkway or at a mitigation bank, the cost will increase.

[3] The real estate cost for the current plans have not yet been determined. The real estate cost estimate from the 2002 2nd Addendum to the SIR for the Mayhew levee of the same height is $244,000 for a 3,300 foot levee and 1,000 foot floodwall that requires 8.2 ac of flood levee easement, 1.8 ac of temporary work area easement and 1 ac of staging area.

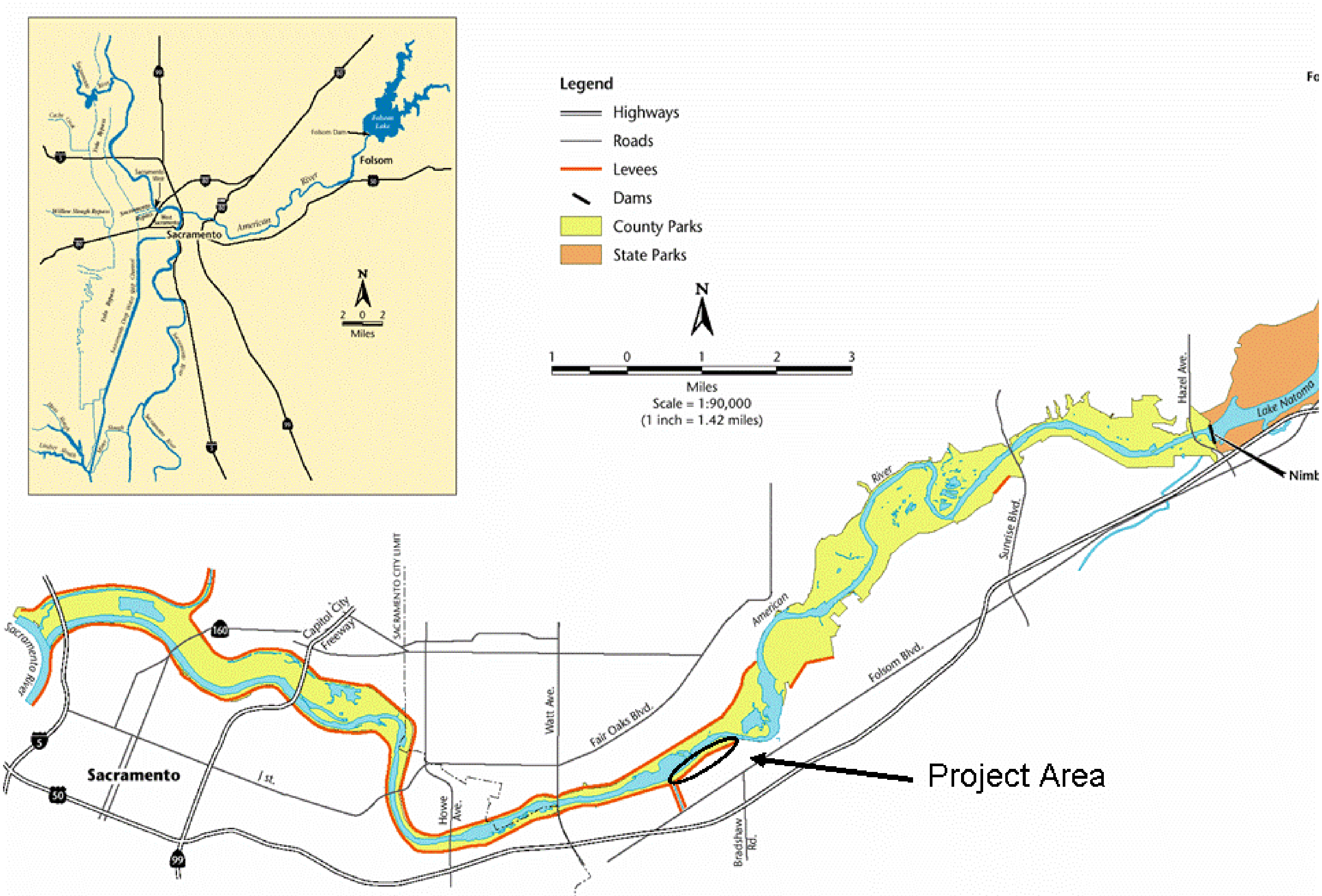

Plate 1 Mayhew Levee Improvement Project Vicinity Map.